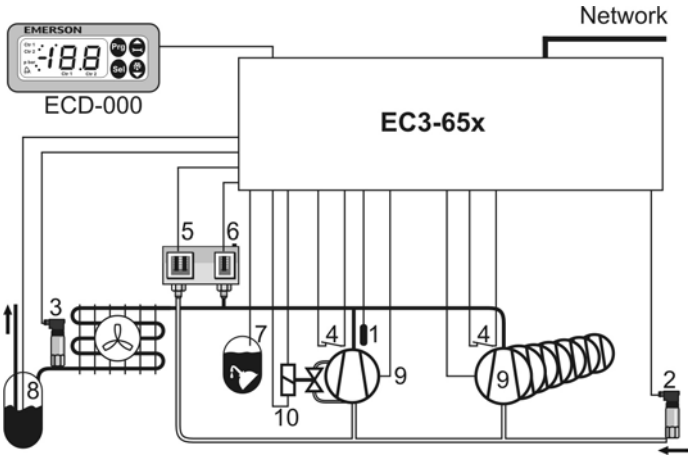
EC3-652 Rack Controller and ECD-000 Display Unit

Operating Instructions

GB

Note: This document contains short form instructions for experienced users. Use last column in List of Parameters to document your individual settlings. More detailed information can be found in the User Manual.

The **EC3-652** rack controller is a digital controller for racks in commercial refrigeration applications for controlling up to 8 compressors with conventional on/off step control working on a common suction line. Alternatively, the controller may be configured to control a Copeland Digital Scroll compressor and up to 7 single stage compressors. The control target is to maintain the suction pressure at a defined value by varying the available compressor capacity.



For the measurement of the common suction pressure and the optional discharge pressure, two PT4 pressure sensors (2, 3) with 4–20mA interface can be connected to the controller. The rack controller has eight relay outputs to command the compressors (9). Eight digital inputs for 24V AC/DC or 230V AC are available for the compressor serial alarms (4) plus one for low pressure alarm (5), one for high pressure alarm (6), one for oil level alarm (7) and one for refrigerant level alarm (8). To control the discharge end temperature of the Digital Scroll compressor a temperature input is available (1). When used, the Digital Scroll Compressor operates as the base load compressor with capacity modulation being achieved by temporarily unloading the compressors scroll sets with the Pulse Width Modulated (PWM) signal (10) which controls the compressor unloading valve.

The optional ECD-000 Display Unit can be connected to the EC3-652 for local display of control parameters and for controller setup without the use of a PC. Because the EC3-652 is fully functional without display unit the ECD-000 may be removed at any time.

⚠ Safety instructions:

- **Read installation instructions thoroughly. Failure to comply can result in device failure, system damage or personal injury.**
- **The product is intended for use by persons having the appropriate knowledge and skills.**
- **Ensure electrical ratings per technical data are not exceeded.**
- **Disconnect all voltages from system before installation.**
- **Keep temperatures within nominal limits.**
- **Comply with local electrical regulations when wiring**

Technical Data

EC3 Series Controller

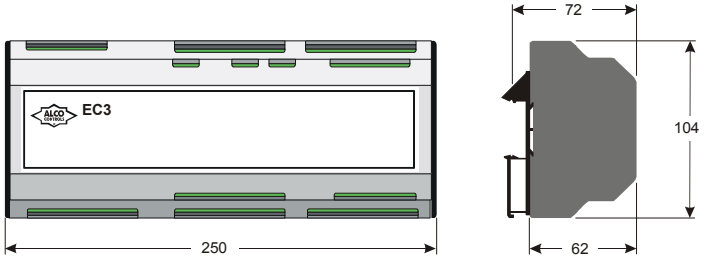
Power supply	24VAC ±10%; 0.5A 50/60Hz; Class II 6.3mm spade earth connector
Power consumption	20VA max.
Communication	TCP/IP Ethernet 10MBit/s
Plug-in connector size	Removable screw terminals wire size 0.14 … 1.5 mm²
Temperature storage operating	-20 … +65°C 0 … +60°C
Humidity	0…80% r.h. non condensing
Protection class	IP20
Pressure transmitter inputs	24VDC, 4...20mA
Temp 1: for Digital Scroll (Dynamic based on settings) Temp. 1 input discharge (1) Temp. ambient	NTC 86kΩ @ 25°C, -40 … +180°C Applies if C4= 2 & F5= 2 1 MΩ @ 25°C, +50 … +150°C NTC 10 kΩ @ 25°C, -50 … +50°C
Digital Inputs	24VAC/DC or 230VAC
Compressor output relays (8x) + General alarm output Digital scroll output ⚠	Inductive (AC15) 250V/2A Resistive (AC1) 250V/8A Semi-conductor switch, 24 … 230 VAC, 2A The coil must be rated for the voltage applied to the input

ECD-000 Display Unit

Power Supply	From EC3-652 via connecting cable
Display	2½-digit red LED with decimal point reversible between °C and °F
LED indicators	Controller 1, Controller 2, p bar, Alarm, IR status
Temp & Humidity	Identical to EC3-652 specifications above
Protection class	IP65 (front protection with gasket)
Connecting cable	ECC-N10 (1m), ECC-N30 (3m), ECC-N50 (5m) or CAT5 cable with RJ45 connectors

Mounting

The EC3-652 can be mounted onto a standard DIN rail.



The ECD-000 can be mounted in panels with a 71x29 mm cutout. See dimensional drawing below for space requirements including rear connectors.

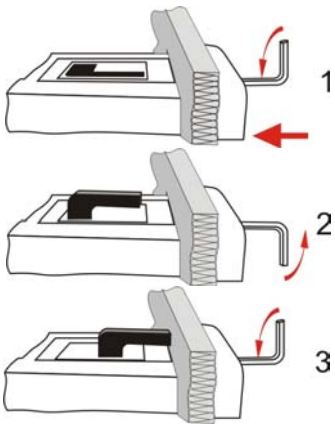
Push controller into panel cutout. (1)

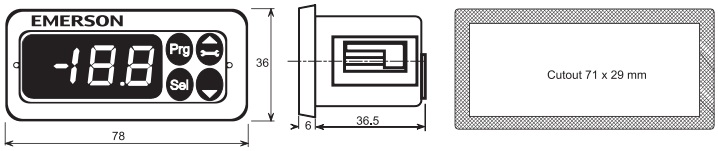
Make sure that mounting lugs are flush with outside of controller housing

Insert allen key into front panel holes and turn clockwise. Mounting lugs will turn and gradually move towards panel (2)

Turn allen key until mounting lug barely touches panel. Then move other mounting lug to the same position (3)

Tighten both sides very carefully until display is secured. Do not over tighten as mounting lugs will break easily.





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Electrical Installation

Refer to the electrical wiring diagram (below) for electrical connections. A copy of this diagram is labeled on the controller. Use connection wires/cables suitable for 90°C operation (EN 60730-1). Ground the metal housing with a 6.3mm spade connector.

Important: Keep controller and sensor wiring well separated from mains wiring. Minimum recommended distance 30mm..

Warning: Use a class II category transformer for 24VAC power supply (EN 60742). Do not ground the 24VAC lines. We recommend to use one transformer per EC3 controller and to use separate transformers for 3rd party controllers, to avoid possible interference or grounding problems in the power supply. Connecting any EC3 inputs to mains voltage will permanently damage the EC3.

Setup and Parameter Modification Using the Keypad of the ECD-000

For convenience, an infrared receiver for the optional **IR remote control unit** is build-in, enabling quick and easy modification of the system parameters when a computer interface is not available.

Alternatively, the parameters can be accessed via the 4-button keypad. The configuration parameters are protected by a numerical password. The default password is "12". To select the parameter configuration:

- Press the **PRG** button for more than 5 seconds
  A flashing 0 is displayed
- Press ▲ or ▼ until 12 is displayed; (password)
- Press **SEL** to confirm password
  The first modifiable parameter code is displayed (/1).

To modify parameters see Parameters modification below.

Parameter Modification: Procedure

- Press ▲ or ▼ to show the code of the parameter that has to be changed;
- Press **SEL** to display the selected parameter value;
- Press ▲ or ▼ to increase or decrease the value;
- Press **SEL** to temporarily confirm the new value and display its code;
- Repeat the procedure from the beginning "*press* ▲ or ▼*to show...*"

To exit and save the new settings:

- Press **PRG** to confirm the new values and exit the parameters modification procedure.

To exit without modifying any parameter:

- Do not press any button for at least 60 seconds (TIME OUT).
- Press "**ESC**" on IR remote control.

Special Functions:

The Clear Alarm function has been replaced by the Special Functions mode. The Special Functions can be activated by:

- Press ▲ and ▼ together for more than 5 seconds.
  A flashing 0 is displayed.
- Press ▲ or ▼ until the password is displayed (default = 12). If password was changed, select the new password.
- Press **SEL** to confirm password
  A 0 is displayed and the Special Function mode is activated.
- Press ▲ or ▼ to select the function. The number of special functions is dynamic and controller dependent. See list below.
- Press **SEL** to activate the function without leaving the special function mode.
- Press **PRG** to activate the function and leave the special function mode.

Most of the Special Functions work in a toggle mode, the first call activates the function, and the second call deactivates the function.

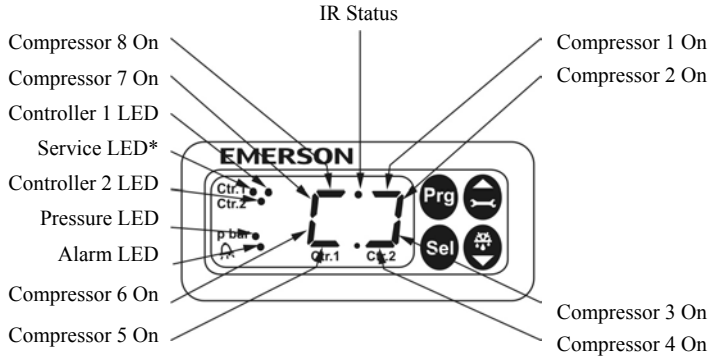
The indication of the function can only be displayed after exiting the special function mode.

- 0: Display test function
- 1: Displays the current TCP/IP address
- 2: Set the controller's TCP/IP address to 192.168.1.101 (default value). This change is only temporary. A power down will reset the previous address.
- 3: Resets all parameters to the factory default setting. The controller will indicate "oF" during the reset.

Display of Data:

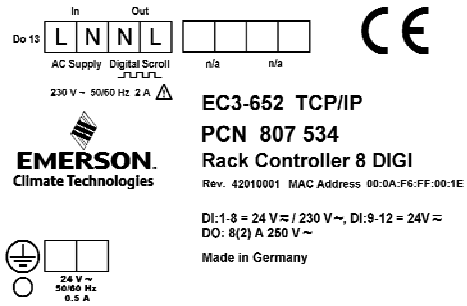
The data to be permanently shown on the display can be selected by the user (parameter /1). In case of an alarm, the alarm code is displayed alternately with the selected data. The user can inhibit the alarm code.

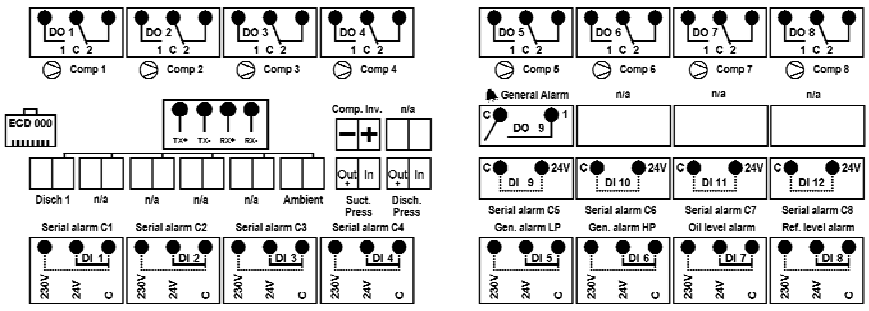
It is possible to temporarily display these values. This is a useful feature when initially setting-up the system without the aid of the WebPages. Press the **SEL** button to scroll through all possible displayable data.. The display will show for one second the numerical identifier of the data (see /1 parameter) and then the selected data. After two minutes the display will return to the by parameter /1 selected data. This action is only valid when parameter H2 = 3



* only active when service pin is pressed

Wiring Diagram (controller label)





List Of Parameters

/	DISPLAY PARAMETERS	Min	Max	Unit	Def.	Custom
/1	Value to show 0 = Compressors states 1 = Suction pressure (bar) 2 = Suction temperature (°C) calculated from suction pressure 3 = Condensing pressure (bar) 4 = Condensing temperature (°C) calculated from discharge pressure 5 = Digital Scroll capacity (%)	0	5	-	0	

P	SET-POINT PARAMETERS					
P0	Suction pressure set point	-1	50	bar	3.0	
P1	Suction band	0	50	bar	2.0	
P3	Fast recovery from low pressure	-9.9	50	bar	-9.9	
P4	Suction shift (0=disabled, 1=enabled)	0	1	-	0	
P5	Suction shift max	0	3.0	bar	3.0	
P8	High discharge pressure recovery	-9.9	50	bar	50.0	
P9	Discharge recovery step	0	5.0	bar	1.0	

t	TIME PARAMETERS					
t0	Integration time	30	99	10 sec*	60	
t1	Time delay before adding capacity	0	99	10 sec*	6	
t2	Time delay before removing capacity	0	99	10 sec*	0	
t3	Compressor min on time	0	99	10 sec*	6	
t4	Compressor min off time	0	99	10 sec*	6	
t5	Maximum compressor switching (0=number of switching unrestricted)	0	199	1/hr	0	

A	ALARM-PARAMETERS					
A0	Alarm delay LP	0	99	10 sec*	0	
A1	Alarm delay HP	0	99	10 sec*	0	
A2	Suction alarm min. limit	-1.0	50	bar	1.0	
A3	Suction alarm max. limit	-1.0	50	bar	6.0	
A4	Alarm delay suction min. limit	0	99	10 sec*	0	
A5	Alarm delay suction max. limit	0	99	10 sec*	0	
A6	Maximum discharge temperature	50	150	°C	130	
A7	Maximum discharge temperaturedelay	0	99	10 sec*	3	
A8	Alarm delay serial alarm compr.	0	99	10 sec*	0	
A9	Compressor service interval	0	99	10, 000 hr**	0	

u	STEP ENABLE PARAMETERS					
u0	Comp service interval reset 0 = do nothing 1 = reset operating time compressor 1 2 = reset operating time compressor 2 3 = reset operating time compressor 3 4 = reset operating time compressor 4 5 = reset operating time compressor 5 6 = reset operating time compressor 6 7 = reset operating time compressor 7 8 = reset operating time compressor 8 9 = reset operating time all compressors	0	9	-	0	
u1	Compressor enable 1 (0=disable, 1=enable)	0	1	flag	1	
u2	Compressor enable 2 (- " -)	0	1	flag	1	
u3	Compressor enable 3 (- " -)	0	1	flag	1	
u4	Compressor enable 4 (- " -)	0	1	flag	1	
u5	Compressor enable 5 (- " -)	0	1	flag	1	
u6	Compressor enable 6 (- " -)	0	1	flag	1	
u7	Compressor enable 7 (- " -)	0	1	flag	1	
u8	Compressor enable 8 (- " -)	0	1	flag	1	

* These values have a resolution of 10 sec, on the local display. Example a value 2 means 20 sec.

** These values have a resolution of 10,000 hours, on the local display. Example a value 2 means 2.000 hours.

c	APPLICATION PARAMETERS	Min	Max	Unit	Def.	Custom
c1	Number of compressors	1	8	-	8	
c3	Compr. control mode (0 = P mode, 1 = PI mode, **2 = dead band mode** 3 = binary mode)	0	3	-	**2**	
c4	Compressor 1 control mode: 0 = in standard control loop 1 = act as base load compressor 2 = act as modulating capacity; single stage;	0	1	flag	2	
c5	Compressor rotation 0 = FILO logic (First In, Last Out) 1 = FIFO logic (First In, First Out)	0	1	flag	1	
c6	Sensor fail (number of compressors in case of sensor failure)	0	8	-	0	
h0	Condensing pressure 0 = not available; 1 = available	0	1	flag	1	

r	SENSOR PARAMETERS					
r0	Suction sensor 0%	-1.0	50	bar	-0.8	
r1	Suction sensor 100%	-1.0	50	bar	7	
r2	Suction sensor offset	-1.0	1.0	bar	0.0	
r3	Discharge sensor 0%	-1.0	50	bar	0.0	
r4	Discharge sensor 100%	-1.0	50	bar	30	
r5	Discharge sensor offset	-1.0	1.0	bar	0.0	
r6	Refrigerant 0 = R 22 3 = R 404A 1 = R 134a 4 = R 407C 2 = R 507 5 = R 410A 6 = R 124 7 = R 744	0	7	-	3	

F	MODULATING PARAMETERS					
F2	Compressor min. capacity	10	100	%	10	
F3	Compressor max. capacity	10	100	%	100	
F5	Analogue output mode for Comp. 1 0 or 1= 0 - 10V ; 2 = PWM (digital)	0	2	-	2	
F6	PWM cycle time	10	20	sec	10	

H	OTHER PARAMETERS					
H2	ECD Display access 0 = all disabled (Caution, access to controller only via TCP/IP network possible) 1 = Keyboard enabled 2 = IR remote control enabled 3 = Keyboard and IR remote control enabled	0	3	-	3	
H3	IR access code	0	199	-	0	
H5	Password	0	199	-	12	

Alarm Codes

HP **General alarm HP**
High pressure signal from digital input

LP **General alarm LP**
Low pressure signal from digital input

hP **Limit violation suction side**
Suction pressure higher than the maximum limit

lP **Limit violation suction side**
Suction pressure lower than the minimum limit

EP **Sensor failure suction side**
Suction pressure sensor failure

Ed **Sensor failure condenser**
Discharge pressure sensor failure

Fr **Fast recovery suction low**
Fast recovery from low suction pressure

hr **Fast recovery condensing**
High discharge pressure recovery

d1 **Discharge temperature alarm 1**
Discharge end temperature from compressor 1 is to high

E1 to E8 **Serial alarm**
E1: Digital input associated with compressor 1 has changed into alarm state (safety chain)
E2, E3 … E8: Digital input associated with compressor 2, 3 … 8 has changed into alarm state (safety chain)

n1 to n8 **Service alarm compressor**
n1: Compressor 1 operating time higher than run limit
n2: Compressor 2 operating time higher than run limit
n3: Compressor 3 operating time higher than run limit
n4: Compressor 4 operating time higher than run limit
n5: Compressor 5 operating time higher than run limit
n6: Compressor 6 operating time higher than run limit
n7: Compressor 7 operating time higher than run limit
n8: Compressor 8 operating time higher than run limit

oL **Oil receiver level alarm**
Oil level detection from digital input

rL **Refrigerant level alarm**
Refrigerant level detection from digital input

Er **Data error - out of range**
Data send to the display is out of range

Messages

--- **No data**
The display will show an "---" at node start up, when no data is send to the display or when the display is disabled.

In **Configuration data initialization**
The display will show an "In" when the configuration data are initialized with the factory default values.

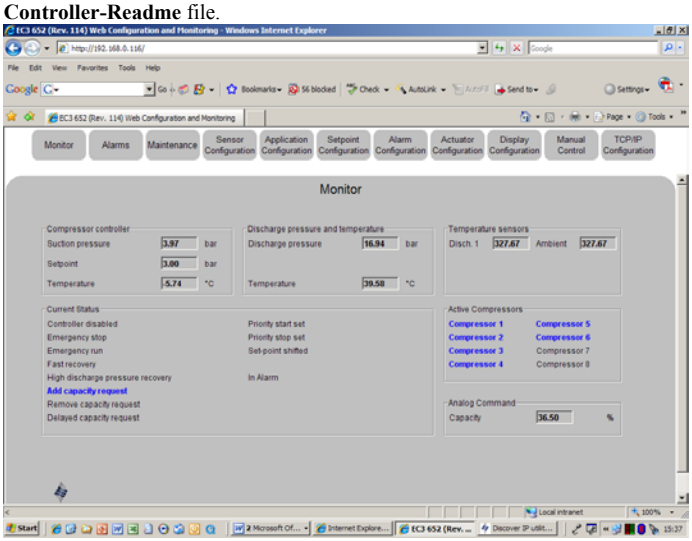
Id **Wink request received**
The display will show a flashing "Id" when the wink request was received. The node will receive the flashing "Id" will be shown on the display until the service button will be pressed, or a 30 min delay timer will expire or a second wink request.

oF **Offline**
The node is offline: no application is running. This is the result of a network management command an will happen

- -- --- **Controller disabled, waiting for restart**
After a major change of the configuration parameter, the rack controller is disabled for 20 seconds. After this delay the controller restart automatically.

Visualising Data: WebPages

A **TCP/IP Controller-Readme** file is available on the **www.emersonclimate.eu** website to provide detailed information about TCP/IP Ethernet connectivity. Please refer to this file if you need information beyond the contents of this instruction sheet.
The **EC3-652** has a TCP/IP Ethernet communication interface enabling the controller to be directly connected to a PC or network via the standard Ethernet port. The **EC3-652** controller has embedded WebPages to enable the user to easily visualise the parameter lists using real text labels.
No special software or hardware is required.
Connect the **EC3-652** using the optional ECX-N60 cable assembly to a network or hub that enables the controller to receive a dynamic TCP/IP address. If a DHCP server is not available, the controller can be connected to a computer using a crossover cable plugged directly into the Ethernet port. In this case, the TCP/IP address of the computer must be manually modified to be compatible with the default address of the controller. Refer to the **TCP/IP Controller-Readme** file for more details.
Open the Internet browser program on the computer and enter the default TCP/IP address of the controller into the address line of the Internet browser: **192.168.1.101** or the dynamic address from the DHCP server. Refer to the **TCP/IP Controller-Readme** file if a specific port is required.
After a few moments, the default monitoring page should be displayed. If the browser does not open the default page or display active data, the user should check the Internet browser "Option" configuration. Refer to the **TCP/IP Controller-Readme** file.



The Monitoring and Alarm WebPages are read only and therefore it is not necessary to enter a username or password. A username and password will be requested upon the initial request to any of the other WebPages. The factory default settings are :
Username : EmersonID **Password : 12**
The default settings may be modified in the Display configuration page.
Press the tabs at the top of the Monitoring page with a left click of the mouse button to enter the respective Webpage.
The parameters will be visualised in real text together with the program code as defined in the parameter list below.
After the parameters have been modified, the complete list of settings can be saved to the memory of the computer and used later to upload into another controller. This can save a considerable amount of time when using multiple controllers and over a period of time, a library can be created containing the parameter lists for equipment for different applications.
It is also possible to display live graphical data from the controller. In addition, a permanent 30 days log file containing the control temperature at 15 minutes intervals is stored in the non-volatile memory to be later transferred using FTP to the computer. The log file can be imported into a standard spreadsheet program such as Excel. Refer to the **TCP/IP Controller-Readme** file for a complete description of the features available for the TCP/IP series of controllers.

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This document replaces all former versions

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